REVIEWS AND DESCRIPTIONS OF TABLES AND BOOKS

The numbers in brackets are assigned according to the American Mathematical Society classification scheme. The 1991 Mathematics Subject Classification can be found in the annual subject index of *Mathematical Reviews* starting with the December 1990 issue.

14[65-01].—DAVID KINCAID & WARD CHENEY, *Numerical Analysis—Mathematics of Scientific Computing*, Brooks/Cole Publ. Co., Pacific Grove, California, 1991, viii+690 pp., 24 cm. Price $50.00.

All that is required to understand the mathematics of scientific computing, its algorithms, and its software libraries can be found in the ten chapters of this scholarly exposition. The authors designed a compact, attractive, uncrowded text that contains a wealth of material, by skillfully using TEX to prepare the manuscript. The subject matter has been tested through many years of research, classroom use, and practical computing experience—during which the algorithms have been refined and precisely defined in "pseudocode."

Homotopy methods of recent vintage are described in Chapter 3 and are used, in particular, to motivate the idea for Karmarkar's interior method to solve linear programming problems—while a more detailed analysis of convexity, the simplex method, tableaus, and duality are presented in the last chapter. Explanation of how and why the multigrid method works for solving elliptic partial differential equations is based on a heuristic description of its use to solve a second-order ordinary differential equation.

The mathematical treatment is suitable for upper-level undergraduate and first-year graduate students who can work with the ideas of analysis that are so carefully presented here. Other readers may compensate for a not so thorough mathematical background, provided they have the skill to work with computers and are motivated to learn from the many computer exercises that are listed in the ample problem sets.

Perhaps there may be a need for a sequel, when parallel computing systems become widely available—the authors could then well provide another masterpiece.

0025-5718/92 $1.00 + $.25 per page

Chapter 9. Numerical Solution of Partial Differential Equations – 64 pages
Chapter 10. Linear Programming and Related Topics – 26 pages
Answers and Hints (to selected exercises) – 5 pages
Bibliography – 16 pages
Index – 8 pages

E. I.

15[65-06, 65Fxx, 65D07, 65K99].—M. G. Cox & S. Hammarling (Editors), *Reliable Numerical Computation*, Clarendon Press, Oxford, 1990, xvi+339 pp., 24 cm. Price $75.00.

The work and personality of J. H. Wilkinson has had a profound impact on setting standards for numerical computations, especially those hard-working modules of numerical linear algebra software that most computer users often use but seldom see, and just have to rely upon. A generation of numerical analysts, including this reviewer, felt happiness from some encouraging words, and challenge from some intriguing remarks, received from J. H. Wilkinson and written on the characteristic mechanical typewriter that stood in his office at NPL (National Physical Laboratory) east of London.

This volume documents the talks given at a conference devoted to his memory at NPL in 1989. Most of the 18 contributions are research papers, adding new stones to the building to which J. H. Wilkinson laid the foundations.

Appropriately enough, it starts out with matrix eigenvalues: B. Parlett continues his 15 years of studying the Lanczos algorithm by giving a theoretically sound and graphically convincing explanation of a seemingly erratic convergence behavior, and C. L. Lawson and K. K. Gupta apply Lanczos to a very special case. J. Demmel puts a discussion of Wilkinson on how to detect when a matrix is close to defective in a differential geometric context, and T. Beelen and P. Van Dooren give a new algorithm for approximating the Jordan Normal Form of such a defective matrix.

Continuing with linear systems, C. C. Paige studies QR factorizations appropriate for generalized least squares, while N. J. Higham studies Cholesky decomposition of semidefinite matrices, and A. Björck iterative refinement. Four papers deal with sparsity, two of these, with I. S. Duff involved, deal with multifrontal methods and tearing, one by M. G. Cox with block angular coefficient matrices, while sparse quadratic programming is discussed by P. Gill, W. Murray, M. Saunders, and M. Wright, the four-leafed trefoil who carried the Wilkinson spirit to the optimization community.

Two contributions deal with rounding errors: F. Chatelin and M. C. Brunet study a probabilistic model, and F. W. J. Olver an alternative to floating point which is closed under arithmetic operations. J. H. Varah estimates parameters in differential equations, G. W. Stewart solves homogeneous linear inequalities, and C. H. Reinsch studies shape-preserving splines.

The last two contributions deal with mathematical software: D. A. H. Jacobs and G. Markham give a software engineering perspective, and J. Dongarra and S. Hammarling report on the current status of dense linear algebra routines.

The book also contains a historical prologue by G. H. Golub, the principal propagator of the ideas of J. H. W., and a very personal epilogue by his colleague L. Fox.